



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/724,938	12/01/2003	Yu-Ting Cheng	YOR920030286US1(8728-659)	3222
46069	7590	11/20/2006	EXAMINER	
F. CHAU & ASSOCIATES, LLC 130 WOODBURY ROAD WOODBURY, NY 11797			HA, NATHAN W	
			ART UNIT	PAPER NUMBER
			2814	

DATE MAILED: 11/20/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/724,938

Applicant(s)

CHENG ET AL.

Examiner

Nathan W. Ha

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 06 September 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 12-18 and 22-28 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 12-18 and 22-28 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

**DETAILED ACTION**

***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 12-18 and 23-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brintzinger (US 2003/0127743, previously cited) in view of Dubin et al. (US 2005/0062169, previously cited, hereinafter, Dubin.)

In regard to claims 12 and 23, in figs. 1-6, Brintzinger discloses a method for forming an interconnection structure for flip-chip attachment of microelectronic device chips to packages, comprising:

forming a barrier layer 2 over a substrate 1;

forming an adhesion layer 3 over the barrier layer;

forming a resist layer 7 over the adhesion layer, the resist layer having an opening that exposes the adhesion layer;

forming first solderable layer 4 over the adhesion layer through the opening the resist layer, wherein the solderable layer is made of copper;

forming a second solderable layer 5 over the copper layer through the opening in the resist layer, fig. 6 shows this feature, wherein the second solderable comprises nickel, see also [0034];

removing the resist layer;

removing portions of the barrier layer and the adhesion layer that extend beyond the first solderable layer, the diffusion layer and the second solderable layer, fig. 5. It is further noted that a solder bump will be formed on this structure as suggested in paragraph [0034].

Brintzinger further discusses the feature of the solderable layer 6 such for layer conductive bump can be formed thereon. However, he does not expressly show a diffusion barrier layer made of CoWP between the copper layer and the nickel layer.

Dubin, in fig. 4, for example, discloses an analogous device including substrate 405, first solderable layer 415 on the substrate, a diffusion barrier 425, a second solderable 434, and solder ball 410. Dubin further suggests that the diffusion barrier is formed between first and second solderable layer, and specifically on top of the first solderable layer which is made of copper. This arrangement provides an advantage of preventing the diffusion of the materials from layers 435 and 410, or preventing whisker formation. See also paragraphs [0035-0037].

Therefore, it would have been obvious to one of ordinary skilled in the art at the time of the invention was made to further recognize forming a CoWP diffusion barrier on the copper as taught by Dubin in order to take the advantage as mentioned above.

In regard to claims 13 and 28, Brintzinger discloses photoresist layer is formed around the barrier layer, the adhesion layer, the first and second solderable layers and the diffusion barrier layer. Photoresist material is a form of polyimide material.

In regard to claim 14, Brintzinger further discloses that the step forming the barrier layer comprises sputtering. See paragraph [0029].

In regard to claim 15, Brintzinger further discloses wherein the step of forming the adhesion layer comprises sputtering. See paragraph [0029].

In regard to claims 17 and 25, Brintzinger further discloses that the step of forming the diffusion barrier layer comprises electroless deposition. See the discussions in paragraphs [0033-0034].

In regard to claim 24, Brintzinger discloses all of the limitations as mentioned in claims 1 and 23 above and further discloses a method of electrolytic the adhesive layer. See [0029].

In regard to claim 27, Brintzinger further discloses  
removing the resist layer after the first solderable layer, the diffusion barrier layer and the second solderable layer are formed; and  
removing portions of the barrier layer and the adhesion layer that extend beyond the first solderable layer, the diffusion barrier layer and the second solderable layer after the resist layer is removed. See figs. 6-7.

Therefore, it would have been obvious to one of ordinary skilled in the art to substitute the barrier layer as taught by Jin in Brintzinger's in order to take the advantage as mentioned above.

In regard to claims 16, 18 and 26, Dubin further discloses that the solderable layers 415 and 435 are made by electroplating method to provide uniform thickness. See also, [0037].

Therefore, it would have been obvious to one of ordinary skilled in the art at the time of the invention was made to use the well known method such electroplating in order to control the thickness of the barrier layer.

3. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Brintzinger and Dubin as applied to claims 12-18 and 23-28 above, and further in view of Jin et al. (US 2004/0178503, previously cited, hereinafter, Jin.)

In regard to claim 22, the combination Brintzinger and Dubin discloses all of the claimed limitations as mentioned above, except further disclose that the solder ball is formed by solder screening, or printing. However, this method is widely used in semiconductor package where solder paste is screened through a stencil, therefore, results in a solder bump height can be properly controlled. See [0040].

Therefore, it would have been obvious to one of ordinary skilled in the art to substitute use the method as taught by Jin in Brintzinger and Dubin in order to take the advantage as mentioned above.

### ***Response to Arguments***

4. Applicant's arguments filed 9/6/06 have been fully considered but they are not persuasive. For instance, the Applicants argue that the cited art, Brintzinger/Dubin, do not disclose a barrier layer made of CoWP between Cu and Ni layers. As mentioned above, Brintzinger discloses the method of making the interconnection structure including all of the layers as claimed. What missing in the Brintzinger is the material of the barrier layer such CoWP. The missing material is found to be obvious. As a result,

Art Unit: 2814

Dubin is incorporated herein to show the obviousness of the material. This combination is clearly recognized by one of ordinary in the art since Dubin in fact discloses an analogous structure wherein the material such CoWP is suggested. The label such "barrier" tells so much of the function of the layer. It prevents diffusion from the top layer during the re-flow of the solder material. It is further noted that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

5. Cancellation of the claims is also noted.

### ***Conclusion***

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

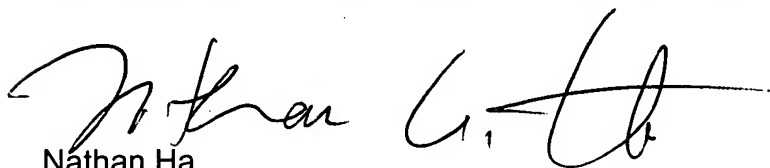
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Art Unit: 2814

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nathan W. Ha whose telephone number is (571) 272-1707. The examiner can normally be reached on M-TH 8:00-7:00(EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'Nathan Ha', followed by a stylized flourish or second signature.

Nathan Ha  
Primary Examiner  
November 12, 2006